CHAPTER 4

FINDINGS

4.0 Introduction

The findings referred to the information gathered from 30 S and T teachers and 100 Form 4 students studying S and T subjects in the three selected day secondary schools. The information provided the means to unfold the process of implementation of the 60:40 policy in these schools. This chapter therefore involved the stage 8 (Findings) of the Research Methodological Process.

4.1 Analysis of Data in relation to the four research questions

The four research questions had helped as guides to finding the answers to the specific areas defined in the theoretical framework from the three selected sites.

4.1.1 First Research Question

"How have the prevailing school factors influenced students to study science and technology subjects?"

The school factors involved two main aspects existing in the three secondary schools such as the characteristics of the schools and the disposition of the implementers (the teachers).

(1) Characteristics of the schools.

The school characteristics referred to the facilities for teaching and learning of S and T subjects, the human resources i.e. the students and the implementers of the policy and the curriculum.

(a) Facilities for teaching and learning of S and T in the secondary schools

The teachers said that the school facilities were in "critical" condition (Table 4.1). The word 'critical' meant something was serious or important and actions needed to be taken quickly.

They said, "The schools are always short of funds for improving the facilities to accommodate the increasing number of students each year and the teaching facilities in the schools for S and T are inadequate and not up to the mark to pull students to do S and T studies." The teachers went on and said, "The ICT facilities are not up to date with the state of the art. Furthermore the practical laboratories are not fully equipped while the school library facilities are not on par with current development." The teachers also indicated that there was no access to "latest textbooks and reference books for science and technology subjects and the provision of computers for the use of the students are always not enough." They further said, "The existing computers are not maintained because there is no fund for it."

Table 4.1: Six types of facilities for teaching and learning in critical situation

School:	A	B	C	Average
1. Allocation of funds is sufficient with the increase of students.	3	3	3	3
2. Teaching and learning resources and equipment cannot be be upgraded due to lack of funds.	3	4	3	3
3. Infrastructure facilities built in according to increase of students each year.	3	4	3	3
4. ICT facilities on par with current development	3	4	3	3
5. Labs for practical training fully equipped with latest hi-tech facilities	3	4	3	3
6. School library facilities on par with current development	3	4	3	3

1= totally not critical 2= quite critical 3= critical 4= very critical 5= extremely critical

Source: Appendix A: Part C, items 21-26.

(b) Teachers

26 out of 30 participating teachers had more than ten years of teaching experience and they came to know of the 60:40 policy from different sources (the school, press and

other people). 12 of them had participated in the policy programme in the early years of its implementation.

The schools always faced the problem of not having enough trained science teachers. Teacher Siew said, "This results in having more than 40 students per class e.g. 140 students are housed in 3 classes, and lacking of time to conduct experiments and teachers not wanting to take risk." Furthermore, teacher Raju touched on a very critical point when he said, "Good quality teachers have retired and new teachers have replaced them and the situation has changed."

(c) Students

Teacher Navitha said, "The students do not have the right attitude and aptitude and the intelligence to study S and T." This was agreed by teacher Jasinila who justified, "The students have no respect for us, as their teachers and their moral value is not there. They rely more on tuition teachers than the school teachers. They look down on the school teachers." Teacher Aisah pointed out, "Students have the tendency to have the teachers to tell them everything and want only to know how to answer in exams but not for the sake of knowledge." Teacher Chin then added, "They are not keen to look for the answers by themselves. Students are not learning by themselves." Teacher Mary, on the other hand, said, "It is easy to teach maths to science students but since students have been forced to take up science due to the policy the situation has changed." She reasoned that "PMR students with low pass grades in maths and science are allowed to do science in Form 4 and as a result they do not show great interest in their study especially those whose lives have become easy as their parents are well off." However teacher Mary also pointed out, "Well-educated parents showed more concern of their children's education." Teacher Monica also agreed and said, "Students tend to take life easy especially those who have been spoon-fed and pampered by their parents but they

did not know that S and T demands intellectual ability and time." However, she was delighted and said, "There are students who are really interested to do S and T and they really do well on their own; they are from more affluent families." Teacher Jesse gave some interesting information when she said, "Teachers' encouragement is only effective to those students who are interested but not the majority. Out of 70 students in 2010, only 10 students continued their study in Form 6." She then continued and said, "Students are being spoon-fed most of the time because they are not creative and do not think creatively. Students like to use gadgets like the latest handphones, i-Pods but do not want to know how they are made." This situation was reinforced and summarised by teacher Joe when she said "The school students are not up to the level of skill or knowledge in S and T and that is something that cannot at this moment considered to be possible within a short period of time." She paused for a moment and then said, "There must be more effort and greater interest to be given to the teaching of S and T in the schools. The teaching facilities in the schools for S and T must also be made adequate and up to the mark to pull students to do S and T studies."

Table 4.2: Thirteen situations relating to students

Critical Condition	Very Critical Condition
1. Achieved unsatisfactory results in science in Form 3.	1. Had low knowledge & skills.
2. Conceived S & T to be difficult.	2. Had low literacy in science.
3. Not interested in S &T.	3. Did not read beyond what they learnt in class.
4. More interested in social sciences.	
5. Unable to give opinion & presentation.	
6. Poor standard of understanding of S & T.	
7. Poor creativity level	
8. Poor participation in class	
9. Selected based on academic result.	
10. Selected not based on personality.	

Source: Appendix A: Part C, items 5-17.

The teachers mentioned 13 conditions relating to the students where ten of them were considered to be 'critical' and three to be 'very critical' (extremely serious) as

shown in Table 4.2. All these conditions reflected the negative aspects of students who were studying science and technology subjects in the three secondary schools.

Looking from the perception of the 100 students when they spoke about their interest in the learning of S and T subjects in the school a very different scenario emerged as shown in Table 4.3.

Table 4.3: Factors influencing students to opt for the Science and Technology Stream

Factors Schools: SMK	B	A	C	Total
1. Self-interest	25	30	28	83
2. Parents' advice	16	13	18	48
3. Information obtained from education exhibition	10	12	16	38
4. Information obtained from the media & internet	9	12	9	30
5. Parents' preference	9	10	10	29
6. Peer influence	10	9	8	27
7. Decided by the school	6	11	8	25
8. Advice from school counsellor	4	5	5	14

Source: Appendix B: Part A, item 4.

Most of the students said, "We choose to study S and T because of our self-interest but not from the advice of our parents. The education exhibition, media and internet, peer influence and decision of the school influenced our choice to study S and T." However advice from school counsellors had little influence on them. Furthermore, most of the students said, "We are satisfied in studying S and T" (Table 4.4).

Table 4.4: Students' satisfaction/dissatisfaction of studying S and T

Students' responses	B	A	C	Total
Satisfied	24	31	31	86
Dissatisfied	9	3	2	14
Total	33	34	33	100

Source: Appendix B: Part A, item 5.

In evaluating the teaching of S and T subjects in the schools (Table 4.5), most students said "The S and T subjects meet our needs and goals for furthering our study and opportunities are provided for our participation." They also affirmed, "The lessons are challenging and improving their understanding of the subject." On the other hand

the students could not give a clear affirmation that the lessons were organised and prepared or they were well taught or they were encouraged to participate.

Table 4.5: Students' evaluation of the teaching of S & T in the schools

Measuring scale	1	2	3	4	5	4 + 5
1. The subject met my needs and goals for furthering my study.	5	5	20	36	34	70
2. Opportunities were provided for student participation.	12	13	15	38	22	60
3. The lessons were challenging and raised my understanding of the subject.	9	15	18	33	25	58
4. The lessons were organised and prepared.	15	18	17	37	13	50
5. The lessons were well taught and encouraged student participation.	17	13	20	34	16	50
6. Textbook and/or materials were useful.	20	16	19	14	31	45
7. The teachers were knowledgeable about the S & T subjects.	18	14	24	24	20	44
8. The class room & other facilities were of an acceptable standard.	16	12	28	30	14	44
9. The lessons were intellectually demanding.	14	15	29	28	14	42
10. The lessons were interesting, clearly presented and helped my understanding of the subject.	28	6	27	24	15	39

1= Strongly disagree 2= disagree 3= Quite agree 4= Agree 5= Strongly agree

Source: Appendix B: Part C.

However, there was a clear affirmation from the students that they were not satisfied with the lessons and teachers in their study of S and T. They said, "The lessons are not interesting or clearly presented and do not help them in their understanding of the subject." They also said, "Lessons are not intellectually demanding and the teachers are not knowledgeable about the S and T subjects."

Table 4.6: Pursuing science and technology education at the higher level

Would you consider pursuing your education in S & T field at the higher level?	Schools B	A	C	Total
1. Yes	25	30	30	85
2. No	8	4	3	15
Total	33	34	33	100

Source: Appendix B: Part A, item 12.

When it involved matters of furthering their education at the colleges and universities, most of the students indicated positively (Table 4.6) as they said, "We are interested to pursue our study of S and T at the higher levels." On the other hand, few students said, "We cannot consider furthering our education after the secondary

schools." These were the students who took up the study of S and T due to other influences but not based on self-interest as what the majority students did.

The students provided ten interesting factors about their interest to pursue the study of S and T at higher levels (Table 4.7). They said, "The most important factor is to increase their thinking ability and then to achieve the desired profession, to acquire skills or profession expertise in the S and T field, to improve family and self-standards within the society, to obtain professions with attractive and adequate salaries, and lastly to widen our knowledge in S and T." They also further commented, "We like to engage in professions suitable to the S and T field and to obtain scholarships or loans to pursue their further studies." They then pointed out, "We are not so interested to widen our social circle with other people in the field of science and technology or to follow the footsteps of their parents."

Table 4.7: Factors encourage Students to further their Education at Higher Level

1 = Totally Disagree 2 = Disagree 3 = Quite Agree 4 = Agree 5 = Totally Agree

Measuring scale	1	2	3	4	5	4 + 5
1. To increase thinking ability	1	1	7	45	46	91
2. To achieve the desired profession	1	2	11	32	54	86
3. To obtain skills or profession expertise in the S & T field	1	0	15	48	36	84
4. To improve family and self-standards within the society	3	6	7	29	55	84
5. To obtain a profession with attractive and adequate salary	1	6	11	25	57	82
6. To widen knowledge in the S & T field	4	0	15	36	45	81
7. To obtain a profession suitable with the S & T field	4	2	17	35	42	77
8. To obtain a scholarship or loan when pursuing education at higher level	3	5	17	28	47	75
9. To widen my social circle with other people in the S & T field	6	7	25	35	27	62
10. To follow the footstep of my parent	21	24	19	23	13	36

Source: Appendix B: Part B.

(d) Curriculum content

Teacher Thelma remarked, "The science curriculum for lower secondary schools has become so easy." Teacher Azlina reinforced this fact when she said, "Students are not getting enough exposure to science in the lower forms. For example, students in Form 3 could not pass the school tests in science and mathematics but could pass them in

PMR." Teacher Ziti had emphatically summarised the situation when she said, "The education system is not encouraging students to take up S and T. Students are given opportunities to do other studies. Students have other interests than to do S and T." After a moment of silence, she continued and said, "S and T makes students to be creative but the system makes it difficult because it is examination oriented. It is not so much for the sake of learning by students but just to teach and finish the syllabus." She then reflected and said, "Teachers should be teaching concepts but it is in conflict with the expectation of results. Teachers just want to finish the syllabus quickly, whether the students understand or not and then proceed to do the revision and just give the students the answers. As a consequence, students do not become creative and the values of the grades, even they are "As", are of no value."

Teacher Francisca gave a suggestion when she said, "The curriculum for S and T subjects must be made appropriate to match the needs of the students and for the policy to succeed and the syllabus need to be improved and more time should be given to the teaching of S and T subjects." Teacher Tham reasoned and said, "Something is not right in the development of the spiral curriculum for the teaching and learning of S and T from the primary school the level of science is not good and this has caused a 'domino effect' to the secondary school level."

(2) Disposition of the Teachers

The disposition of the teachers towards the 60:40 policy was examined from six different aspects. All together twenty-five teachers from the three secondary schools were interviewed. The same propositions were raised to all the teachers to seek their answers. The responses of the teachers were recorded and categorised in Appendix C. The respondent teachers were asked 'the six questions':

1. Is it feasible to encourage more students to study S and T in the secondary schools?

2. What is your state of readiness (intensity) towards the 60:40 policy?

3. Should the teaching of S and T be strongly emphasized in secondary schools?

4. Is the study of S and T at secondary schools crucial for the success of the policy?

5. Are you confident that the policy will come true?

6. Do you believe that the policy is critical for the country to become a developed nation?

1st aspect of teachers' disposition: The feasibility to encourage more students to take up the study of S and T in the secondary schools.

48% of the teachers asserted that it was feasible to encourage more students to take up the study of S and T subjects in the schools. They gave four reasons (Table 4.8).

Table 4.8: Feasible/Not feasible to encourage more students to take up S & T

Teachers believe it is feasible: 48%		Teachers believe it is not feasible: 52%	
Teachers' reasons	%	Teachers' reasons	%
Good students/incentives	43.7	Students' attitude, perception, aptitude & intelligence	47.4
Seriousness of government	37.5	Poor quality students	23.7
Encouragement of parents or teachers	12.5	School situation	10.5
Teaching approach	6.3	Teachers	5.3
		Size of class	5.3
		Syllabus	2.6
		Tuition	2.6
		Parent	2.6
Total	100		100

Source: Appendix C, p. 261.

The teachers said, "The most important requirement is the availability of good students and this can be enhanced with the provision of incentives to encourage students to study S and T subjects." They also said, "The schools are the proper places for the study of S and T." Teacher Anita said, "By selecting only good students to do S and T, then students will see the value to study S and T. If incentives are also provided to such

students then other students can be motivated to do S and T." This was supported by teacher Amy who said, "Students must be motivated to study S and T or else they will go to the arts." Furthermore teacher Annie believed that students should be encouraged to do S and T when she said, "Opportunities are available for higher education to students with S and T knowledge." This idea was reinforced by teacher Aini who indicated, "S and T knowledge is important in our daily life; students need to learn it from the schools where there is proper teaching and guidance from the trained teachers."

The next important requirement was the seriousness of the Government to ensure the implementation of the said policy. Teacher Chong emphatically pointed out, "This is not something new because many developed countries have achieved it. It is a question of how serious the government wanted it to be achieved." Another teacher, Josephine said, "It all depended on how much encouragement is given (by the government) to get the students interested to take up the study of S and T and that the future job prospects are important." Teacher Chee commented, "Provided changes are made in the existing situation to make it possible. It needs the concerted and coordinated efforts of the policy makers and the teachers. Besides having good committed science teachers, more time should be given for the teaching and learning of science in the secondary schools."

As with regard to teachers' encouragement of students to take up the study of S and T, teacher Zainon believed, "Teachers can encourage but not force the students to study S and T. Certain parents want their children to study S and T even though they are not good enough but for parents who are not sure, teachers should encourage that their children to do S and T first and if they decide to switch to the arts stream they can still do so."

With respect to the teaching approach, teacher Aziza believed that the students should be taught according to their levels of capability and that more coaching and attention should be given to the weaker ones. This teacher said, "There are good, average and weak students. Teachers should focus on the good and average students. As for the weak students, give them extra classes during the holidays or after school."

On the other hand a simple majority of the teachers believed that it was not feasible to encourage more students to do the S and T education and they provided eight justifications which were classified into three categories.

1st category

They sighted the *attitude, perceptions and intelligence of students* as the top problems. Teacher Annie started off by saying, "Students do not have the right attitude and perception and the intelligence to study S and T. They generally have negative perception about S and T. They are not able to apply what they learnt or being taught. They are exam-oriented and have difficulty when they come to problem solving. They have the tendency to have the teachers to tell them everything and want only to know how to answer in exams but not for the sake of knowledge." Furthermore according to teacher Jane who said, "Students do not have the quality, analytical ability, the attitude or interest to take up S and T studies. They are not keen to look for the answers by themselves. They are not really learning as they should especially the S and T subjects where they are required to make enquiry and exploration as part of the learning." Yet another teacher, Annie added, "The attitude of students is also causing the problem - they do not like to do homework, they are waiting for answers to be given to them; they depended on tuitions and they are exam oriented. They have no confidence; they do not want to struggle to get things by themselves. They are more interested in entertainment rather than taking up challenges in S and T studies. They considered S and T to be tough and do not like to think or solve problems."

2nd category

The teachers mentioned that the *poor quality of students, school situation, teachers and size of class* were the inhibiting factors to encourage more students to take up the study of S/T subjects. Teacher Sophie identified the problem when she said, "The quality of students is declining each year as it is easy to enter into the science class in Form 4, even with grade Ds in science and maths." With respect to the school situation, teacher Chong said, "The actual situation in the school should be given due consideration first but cannot just follow what happened in overseas and just played with statistics." This was enlightened by teacher Jane who said, "There must be attractions to draw the students in the early years towards the science such as good job prospects, incentives and scholarships. Good students after Form 3 should not be allowed to leave the school to go to other schools." Teachers did not encourage students to do S and T because they knew the students could not do S and T. This was what teacher Sharina said, "PMR is not the criterion to choose students for S and T studies. Teachers know the students who are good enough to get As."

Furthermore, the teachers said that the size of the class as being too big and it affected the teaching and learning of S and T subjects and this was what teacher Siow said, "Too many students are in a class e.g. 50 and there is not enough time to conduct experiments and teachers do not want to take risk."

3rd category

The *Syllabus, tuition and parents* were considered to be the least problem areas. Teacher Ann was of the opinion when she said, "The syllabus has been revamped and become more difficult and therefore it is difficult to score." Teacher Sabrina said, "Students go for tuition to have a head start for the following year subjects … after Form 3 exam. Teacher Anita pointed, "There are parents who do not encourage their

children to do S and T because it is difficult and they will face problems when their children do not do well."

2nd aspect of teachers' disposition: Teachers' readiness towards the policy

The state of readiness is dependent on the degree of expectation of the outcome. If the outcome matched the expectation then the level of motivation would be high; if not then the level of motivation would be low. The state of motivation has a correlation to the effort that is expanded to achieve the outcome. Therefore the state of readiness of the teachers dictates the level of motivation of the teachers and their level of effort to implement the policy. Teachers are excited when they are ready for actions. This provided another aspect of the teachers' disposition toward the implementation of the policy.

Table 4.9: Teachers' readiness towards the 60:40 policy

Teachers ready: 28%		Teachers not ready: 72%	
Reasons	%	Reasons	%
Importance of the policy	57.1	Stagnation of the policy	45.4
Teachers teaching S & T are versatile & capable	42.9	Quality of students	24.3
		Syllabus	18.2
		Teacher's incentives	9.1
		Size of class	3.0
Total	100		100

Source: Appendix C, p. 264.

Most teachers indicated that they were not ready toward the 60:40 policy and they provided five reasons (Table 4.9):

The most important reason was the stagnation of the policy for many years since its inception in 1967. It was still at the strategic intent stage after 45 years. Teacher Tina commented, "The policy has never moved until now and not much has been said about it." Teacher Zarina tried to find the reason and said, "Science is needed for growth of the country. Hope for it but implementation is an issue." Teacher Azizah explained

what had happened, "The policy has been in existence for so many years but nothing has been achieved and in fact fewer students are taking up S and T studies. More students are doing social science studies." Teacher Mona commented, "It is not so realistic in the Malaysian world. Not really wanted to achieve the policy e.g. PPSMI changed again to Bahasa Malaysia and not following the developed world."

The quality of students in the Form 4 class was the next important reason. The teachers were not excited because the students coming to do S and T studies had not reached the expected capability, possessed the right attitude or the ability to think and to solve problems. Good students were mixed with weak students to make up the number. Teacher Aziza commented, "The way it is handled just to create the number but it is actually putting strain on the students and parents. Students find difficulty in their studies of S and T and parents have to get help from other places such as tuition centres." Teacher Jodi said, "Do not have the quality students but forced to fill the requirements as a result they do not perform but create problems in not doing their works and in their exams passed up blank papers. Students getting zero marks are quite common." Teacher Cheong figured out and said, "The quality of the students doing S and T has declined" and she reasoned, "This is because the students who did well in the PRM exam had moved to other schools and their places were filled up with other students."

The Syllabus had been given the third important reason. The teachers commented that the syllabus for science in the lower secondary school level was low and it had become too easy for students. They pointed out that even in the primary schools the level of science was not good and this had escalated to the secondary school. The Ministry's PMR examination could not really tell the quality of the students because students who failed the state PMR trail examination could pass in the Ministry's PMR examination. Teacher Amy felt and said, "The proper thing to do is to have students

capable to do science. By just filling the class to achieve the policy leads to lowering the standard and quality of students. Instead of resolving this situation, the syllabus is made easier to reach the intellectual level of the students." This was what teacher Sally said, "Quality of students doing S and T has declined."

The teachers' and students' incentives had been given as the fourth important reason. Teachers were not encouraged because the government had not given incentives compared to those teaching accounting and economics. Furthermore there were no incentives to encourage more students to take up the study of S and T. Teacher Jenny was of the opinion when she said, "There should be more transparent encouragement given to the students to do S and T by providing more scholarships or incentives and job opportunities as well." Teacher Josephine said, "Not only should the students but the teachers too be given some incentives for their efforts. Furthermore S and T teachers do not get promotion that fast."

Too many students in a class had been considered the fifth reason. Teacher Jenifer said, "The number of students per class can be more than 45 e.g. 140 students are placed in 3 Form 4 classes."

On the other hand, certain teachers were receptive to the 60:40 policy. This was what teacher Elizabeth said, "S and T are needed in all aspects of development and it is good for the country because S and T can provide more job opportunities." Teacher Kennet commented, "The progress of industries depends on S and T." The consequential effect would be that teachers would then have more opportunities for promotion and career development. This was the expectation of teacher Mary who felt that when she said, "The job market is limited for S and T graduates to reach top positions and hope that this situation will change." Another reason these teachers felt excited about the policy was because they knew that they would do it. They said, "We are more versatile and capable to be involved in research and development as well as to

meet the challenges in the teaching of S and T and to keep up with the latest batch of students. We are aware of the importance of S and T in national development." Teacher Catherine said, "Excited to share S and T knowledge with the students because S and T can create more thinking students."

3rd aspect of teachers' disposition: The teaching of S/T should or should not be strongly emphasized in the secondary schools.

This aspect of the research study provided an idea of how teachers gave value to the importance of teaching S and T in the secondary schools. When a greater value was given to the teaching of S/T then more attention was directed to the teaching and learning process. In this way students were given the benefit to acquire the knowledge in S and T subjects. This helped to identify another aspect of the disposition of the policy implementers in how they valued their teaching of the S and T subjects in the schools.

Table 4.10: Teaching of S and T should or should not be strongly emphasized in Secondary Schools

Teachers agreed: 80%		Teacher disagreed: 20%	
Reasons	%	Reasons	%
1. Deciding factors – SPM, Language, need people qualified in S & T	23.7	Most students are not capable to study science	100
2. Students are matured enough to do S & T	21.0		
3. Advantages of studying S & T	18.4		
4. Community's/society's/country's needs for S & T	15.8		
5. Scope for studying S & T is wider	13.2		
6. More time for teaching S & T	7.9		
Total	100		100

Source: Appendix C, p. 267.

Most teachers agreed that S and T should be strongly emphasized in secondary schools (Table 4.10). The teachers gave six reasons to support their claim.

The first reason was given by Janie when she said, "If the students missed the study of S and T in the secondary school and had not sat for it in the SPM, they would not have the opportunity to do it again." Teacher Thelma gave the second reason when she said, "The students are matured enough to study S and T subjects in the secondary schools." This was confirmed by teacher Jane who said, "Students are mature and this is time to expose them to more S and T." Teacher Alice affirmed, "Students in the secondary schools are mature enough to begin seriously to learn S and T."

The third reason was that there were advantages for students to S and T in the secondary schools and this was what teacher Amy reasoned, "S and T enable students to be more capable, inquisitive and creative and they can develop intellectual abilities." Teacher Alice then substantiated it when she said, "Students in S and T are of better quality and competent." Furthermore teacher Aileen said, "Students in S and T are more disciplined and creative and respectful to their teachers."

The fourth reason was that the secondary schools were providing the human resources for the creation of S and T graduates for the needs of the communities and country. Teacher Sally said, "S and T are required to keep things going in the community e.g. supply of water and electricity, buses and trains, cars and lorries, hospitals and so on." This was confirmed by teacher Janie who said, "S and T are needed for the country to progress in this competitive world." Teacher Joie added, "S and T students are needed for the growth of the country. S and T are getting more and more important because the country is always short of S and T people for the development of the country such as doctors, engineers and technocrats."

The fifth reason was that more opportunities existed in the professional fields and job opportunities for S and T students. Teacher Zain said, "Fields of profession are wider for S and T students." The view of teacher Isabela was interesting when she

said, “everything we do has S and T in it. Study of S and T can be applied in our life. Generally people look up to science more than arts.”

The sixth reason was the suggestion that more time should be given for teaching and learning of S and T subjects in the schools to enable the students to acquire better understanding and knowledge of the subjects. Teacher Jolie said, “Science used to be 5 periods per week but now it has been reduced to 4. This is discouraging to complete the syllabus.”

On the other hand certain teachers were of the opinion that science should not be emphasized in the secondary schools. Teacher Jane said, “Science should not be emphasized. However technology subjects should be emphasized as more students are interested. Teachers are frustrated by the quality of the students doing science.” These few teachers’ opinions were based on the fact that since few students were interested to study S and T, there was no necessity to emphasize the study of S and T in the secondary schools. Teacher Tan said, “(I) do not believe it. Only a minority of students could do S and T.” This was supported by teacher Jolie who said, “Students are not interested to do S and T and many prefer the social sciences. There are plenty of choices in the private colleges.”

4th aspect of teachers’ disposition: Whether the study of S and T at the secondary schools is crucial for the success of the policy.

The word ‘crucial’ meant extremely important or necessary according to the Cambridge Advanced Learner’s Dictionary. This implied that the study of S and T by more students at the secondary schools was extremely important for the successful implementation of the 60:40 policy. It had to start at the secondary schools to provide the inputs for the institutions of higher learning to produce the S and T knowledge human resources for the country.

Teachers, who understood the necessity of learning S and T for the policy to come true, would be committed to the teaching of S and T subjects. They would teach the students in the honest way to learn the subjects.

Most teachers agreed that the study of S and T in the secondary schools was crucial for the success of the 60:40 policy (Table 4.11). Their main consensus was that the secondary schools were the proper sites for the teaching of S and T and they had not lost sight of this role of the schools. Teacher Ah Ming said, "Yes, because it is at the schools that the students begin to learn about S and T. It is difficult to imagine how and where else students can learn about S and T, if not at the secondary schools." Teacher Aminah squeaked with excitement and said, "To get the scientists or technocrats for the country as the policy has aimed to do, the universities or colleges depended on the schools to provide them the necessary students to fulfil the 60:40 policy. The schools are the basic sources of supply (of students) to the universities and other higher institutions." Teacher Chin emphasized the fact and said, "If it is not done in schools, how could the students get exposed to S and T." A further reason was given by Teacher Azinie: "S and T knowledge is important in our daily life; students need to learn it from the schools where there is proper teaching and guidance from the trained teachers." Teacher Josephine said, "Fundamentally students in the secondary schools are the sources for the policy to be realised."

Table 4.11: Study of S and T is crucial in Secondary Schools

It is crucial: 80%		It is not crucial: 20%	
Reasons	%	Reasons	%
Schools are the sources for teaching S & T	55.2	Not just the number but affective qualities count	80
Promoting the study of S & T	34.5	Curriculum for S & T too low at secondary schools	20
Curriculum can be improved	6.9		
More time for teaching S & T	3.4		
Total	100		100

Source: Appendix C, p. 269.

Teacher Helen came out with the suggestion when she said, “The importance of studying S and T at the schools should be promoted so that parents will more give attention to their children in the study of S and T.” Teacher Rose warned when she said, “Attitudes and perceptions of the students tend to go for easy courses especially now when there are so many private colleges they can go to. Something must be done to get them to study S and T subjects.” Teacher Tan cautioned that the situation had to start from the school and this was what she said, “The idea is to promote the importance of studying S and T in the schools in order to getting quality students to study S and T and to overcome the problem of quantity.”

Next the teachers were of the opinion that at the present state of development, the setting at 60% science and 40% arts ratio was considered too high. Teacher Rose suggested, “It should be lowered to 40% science and 60% arts and gradually to build up the science ratio to 60%.”

The teachers were also concerned about improving the curriculum of science and mathematics. Teacher Agnes said, “The curriculum for S and T must be appropriate to match the needs for the policy to succeed.” She further commented, “The syllabus needs to be improved and more time should be given to the teaching of S and T subjects.”

However, certain teachers disagreed that the secondary schools were crucial for the success of the 60:40 policy. These teachers had the opinion that it was not possible to get enough good students to fill up the places to achieve 60% of the students after PMR to study S and T. Teacher Josephine said, “It is not the way by just filling the number without considering the human factors such as their passion, interest, attitude and aptitude. It should be based on quality but not quantity.”

The teachers here also concurred with the other group of teachers that the ratio 60:40 was too high, and that a lower ratio could be more appropriate to start with and

then to build it up gradually over time. Another reason was given by teacher Thelma, "Students are not ready somehow."

As with regard to the curriculum, teacher Jolie said, "The science curriculum for secondary schools has become so easy. Furthermore, STPM students cannot get into the public university for the choice of courses; while matriculation students could e.g. students with 3 As in the STPM could not get into the courses they wanted."

5th aspect of teachers' disposition: Having confidence the policy will come true.

Confidence here meant having trust on the policy that it would work and achieve its purpose. The teachers as implementers of the policy needed this confidence in order to discharge their responsibility. Confidence arose when a person was in the state of certainty which was dependent in having the necessary knowledge and information.

Table 4.12: Confidence of the 60:40 Policy will come true

Teachers not confident: 96%		Teachers confident: 4%	
Reasons	%	Reasons	%
1. Changes be made by government, parents & others	37.5	Time will make it possible	100
2. Nature of students	29.1		
3. Policy already there for many years	16.7		
4. Administration work	8.3		
5. Quality of teachers/poor exposure to science	4.2		
6. Education system	4.2		
Total	100		100

Source: Appendix C, p. 271.

Most of the teachers (96%) were not confident that the 60:40 policy would come true (Table 4.12). Their reasons were categorised into 6 areas:

The most important reason was the need to make changes to ensure the successful implementation of the policy. Teacher Alma said, "The policy will succeed if certain changes are made such as taking into consideration the human factors but not based on

supply and demand situation. Look for quality students not just quantity. Opportunities should be given to STPM science students at the public universities to do the courses of their choice. Based on my experience and knowledge, changes are expected in order to make the policy come true." She also said, "Parents and students should change their attitudes and expectations. There must be equal opportunities for education for all races in the country. The good students after the PMR are taken away to other institutions and the others are left to continue in the school." Teacher Chong said, "That changes have to be made if the policy is that important to the nation" and teacher Chen added: "The government should make the effort to make it possible."

The second reason was the nature of students in the sense that they had no interest for S and T. Teacher Chong said, "They do not have the attitude, aptitude and competency to do S and T" and teacher Cheng commented, "20% of the students good in science want to go for the arts and furthermore many parents do not encourage their children to go for science because science is difficult. Even though the school promotes good students to go to science but not all good students want to go for science." The situation appeared quite desperate to get good students to do S and T in the schools. This was the conclusion of teacher Mark, "It is not really possible to visualize now that the policy can certainly come true in the near future. There are more students who are interested in S and T but they do not have the right attitude or interest. The real interested and capable students doing S and T are fewer than the arts or social science students all these years. Currently there are no incentives being provided for students studying S and T." Teacher Annie argued and suggested, "There should be such things as to give special treatments to S and T students then it can be achieved." It was a teacher's lamentation when teacher Bernet said, "Not really certain in the sense that the students have the right maturity to see the importance of S and T to make the policy becoming a reality. They do not want to think or solve problems and always ask for

answers. Only the few good students who prefer to find the answers through their own effort. They are really creative."

The third reason was that the policy had been there for many years but somehow it had not achieved the expected outcome until today. Teacher Mona said, "The Ministry talked but not walked. No real effort is seen but does something that is not useful e.g. sent teachers to go for IT programming but could not implement it in the schools due to lack of facilities or incomplete parts e.g. no screens for projectors. Maintenance is poor or lacking. Teachers also give up because of the waste of time as the syllabus needed to be completed. The use of foreign English teachers to train local teachers did not turn out to be successful. There was no thorough evaluation of programmes implemented."

The fourth reason the teachers gave was too much administrative load for the teachers and as a result they did not have sufficient time for teaching S and T. Teacher Annie said, "It is affected by administrative work rather than time spent fully for teaching the students."

The fifth reason was that the new teachers could not match the quality of teachers who had retired. Teacher Zeta said, "Good quality teachers have retired and new teachers have replaced them. Situation has changed." She further commented, "Students are not getting enough exposure to science in the lower forms. For example students in Form 3 could not pass the school tests in science and maths but could pass them in PMR."

The sixth issue was that the education system did not allow for learning to take place but to finish the syllabus without giving consideration whether the students understand the S and T subjects. Teacher Ang commented, "The education system is not encouraging students to take up S and T subjects because they are exam-oriented. Not so much for the sake of learning by students but just to teach and finish the syllabus.

Teachers are not teaching concepts because it is in conflict with the expectation of results."

However, teacher Alice was the only one who was confident that the policy would come true if given the time. She said, "It will be achieved in time."

6th aspect of teachers' disposition: Believing the policy is critical for the country to become a developed nation in 2020.

The word 'critical' implied 'highly important'. Most teachers (88%) rated the policy as "critical" for the country to become a developed nation. The reasons provided by these teachers were categorised into 3 areas (Table 4.13).

Table 4.13: The 60:40 Policy is for the country to become a developed nation

Teachers said critical: 88%		Teachers said not critical: 12%	
Reasons	%	Reasons	%
1. Importance of S & T	42.8	Can become a developed	
2. Understanding of the policy	28.6	nation without the policy	50
3. As a developed nation	28.6	Students not up to the mark	50
Total	100		100

Source: Appendix C, p. 273.

The most important reason was related to S and T education. Teachers realised that S and T education in the secondary schools was most important for the country to become a developed nation. Teacher Chan said, "S and T are needed for industrialised state of the country. So many things come up; they need the knowledge of S and T e.g. the understanding of Tsunami. Science provides the understanding of how it occurred and how to set up systems of warning." Teacher Tee supported this fact when she said, "Without S and T many things cannot be developed or implemented from agriculture to automobile. Even though cars are made in the country, many parts for cars are imported." This was further supported

by teacher Mariam who said, “It is not easy for a country to become a developed nation; but in reality it is an issue without having the necessary type of people especially those in S and T.” Teacher Chan reminded, “The secondary schools should play this most important role.” Teacher Amy quipped, “There is always a demand for workers who are skilled in S and T. This is because industries need such people.”

Next the teachers sighted that the understanding of the 60:40 policy was necessary for the country to become a developed nation. Teacher Amy reasoned, “Because the success of achieving the developed status depended on achieving the 60:40 policy. S and T subjects are considered the backbone of the policy to produce the professionals in science and technology for the country.” Teacher Mary insisted, “To become a developed nation needed preparation. This means to have a policy for that. The 60:40 policy has not been promoted well enough for the people to know its importance and urgency. Government needs to change the policy that students on scholarships must come back.” Another interesting point was given by teacher Aziza, “The country needs to have more scientists, professionals and technocrats. The policy is the backbone for all these people to be created and for the country to achieve the developed nation status.” On the other hand she reasoned, “The way the 60:40 policy is given the importance is doubtful. Not much talk on the policy has been given to the teachers.” Teacher Chong sized the situation and commented, “The country needs many students with S and T to become a developed nation and this is what the 60:40 policy is for. The industries need such kind of workers.” The teachers understood that as a developed nation there would be progress and production of creative and quality goods and where opportunities would prevail for many professionals to remain in the country. In the process, teacher Alice pointed out, “Countries that are not developed have little job opportunities and low standard of living. Developed nations are progressive and

produce creative and quality goods. Many professionals are leaving the country (that is not developed)." Teacher Jane said, "My dream has been to live in a developed world. More open, interaction in almost everything - behaviour, more progressive and more civilised. Better job opportunities, higher skills and responsibility or trust." Most of the teachers agreed, "Without S and T the country cannot really be developed or to move ahead and that the situation can be seen from many examples prevailing in the country today." They further said, "The country has to depend from many developed countries to buy sophisticated equipment and machineries including cars and lorries from them. Our automobile industry has to depend on Japan and other countries for technology and parts and has not progressed well in terms of its technology to come out with new models."

On the contrary, certain teachers said that the 60:40 policy was not critical for the country to become a developed nation. They said, "The students are not up to the standard for the policy to be achieved. The country has to become a developed nation through other ways."

4.1.2 Second Research Question

"What are the prevailing factor conditions that helped to enhance students' interest towards the study of science and technology subjects in the secondary schools?"

The prevailing factor conditions were the rivalry among schools, strategy, structure, culture and inter-organisational relationships between the policy makers and the policy implementers. These five factor conditions influenced the implementation of the policy in the schools. They helped to provide an understanding of the intellectual capabilities in the schools because they were necessary for the successful implementation of the policy. For example the existence of rivalry challenges the schools to have the ability to perform better than other schools. Strategy, structure and culture were the prerequisites

for the successful implementation of the policy. Inter-organisational relationships provided the strategic strength for the successful completion of a complicated and difficult project like the implementation of the 60:40 policy. The right factor conditions would facilitate the implementation of the policy.

(1) Rivalry (competition) among Secondary Schools

There was competition among the secondary schools as teacher Joe said, "Do not have the quality students in the school because good students from Form 3 left to go to other schools or institutions even though the same school has the upper secondary classes and the Form 6 classes." This was what teacher Chan said, "I feel that good students should not leave the school but to proceed on to the Form 6 class in the same school" while teacher Thelma pointed out that it had been the situation, "Good students after Form 3 leave to go to other better schools."

Schools lost their good students after the PMR results were published, in two possible ways i.e. when the good students asked for transfers to other schools and when the department requested for their transfers. On the other hand, it creates a challenge for the schools to improve their performance and to stop the loss of good students to other schools.

(2) Strategy

A strategy was regarded as a deliberated plan of actions to provide the direction and the guideposts to enable the implementers to achieve the desired objectives. Strategies were normally formulated by those involved in the policy making. In business organisations strategies were formulated by the top management involving the chief executive officer and the departmental managers. In the education system, no such parallel development occurred. The school head teachers and the senior teachers were not involved in the formation of the strategy. As a consequence teachers did not make contributions towards the planning and development of the policy. Teachers were

capable to provide useful contributions to the making of the strategies for the implementation of the policy based on what they said:

- "This depends on how much encouragement is given to get the students to be interested to take up S and T and what is offered to them if they do so."
- "It is a question of how much support is given to encourage the students to do S and T and the future job prospect is important."
- "The teachers are there. Other factors must also be put in place like good quality students and parental support, to make the policy comes true."
- "Provided changes are made in the existing situation to make it possible. It needs the concerted and coordinated efforts of the policy makers and the teachers. Besides having good committed science teachers, more time should be given for the teaching and learning of science in the secondary schools."
- "The actual situation in the schools should be given due consideration first but cannot just follow what happened in overseas and just played with statistics."
- "By selecting only good students to do S and T, then students will see the value of studying S and T. If incentives are also provided to such students then other students will be motivated to do S and T."
- "Teachers have asked to be relieved of administrative works in order to concentrate in teaching to make the policy comes true. Have administrative assistants to do the administrative works."
- "There is no real encouragement from the government as no incentives are given to the S and T teachers compared with those in teaching accounting and economics."
- "This is time for S and T. Learning S and T is gaining knowledge. Students' quality is important too. Should encourage more technical subjects in the schools. Students prefer more on hand-on things."

- "Opportunities are available for higher education to students with S and T knowledge."
- "There must be attractions to draw the students in the early years towards the sciences such as good job prospects, incentives and scholarships."
- "S and T are needed in all aspects of development."
- "It is good for the country because S and T can provide more job opportunities."
- "Not only should the students but the teachers too be given some incentives for their efforts."
- "The progress of the country depended on S and T. The secondary schools are where the students are mature enough to begin seriously to learn S and T."
- "Some students are willing to do S and T but are forced by circumstances to do other studies because of family background. Students from poor families or broken down homes help their parents through part-time working. They earn money to enable them to get what they need such as handphones and for their food. They become more interested to earn whatever money they can get and study becomes less important to them."
- "Students do too many subjects and so their interest for S and T could be diverted."
- "S and T can benefit the students in terms of creativity in the long term as maths involves basically problem-solving."
- "The students' future requires S and T or else they will be left behind."
- "In fact S and T gives the students more choices to study in other institutions e.g. technical schools, colleges."
- "To get more scientists, professionals and technocrats."
- "Need to have S and T students to make the policy possible."
- "Yes because it is at the schools that the students begin to learn about S and T. It is difficult to imagine how and where the students can learn about S and T.

- "To get the scientists or technocrats for the country as the policy has aimed to do, the universities or colleges are responsible to produce them. However the universities or colleges depend on the schools to provide them the necessary students to fulfil the 60:40 policy. As a consequence, the schools become the basic sources of supply of students to the universities and other higher institutions."
- "Students do not have the right attitude and aptitude and the intelligence to study S and T."
- "Students get free education and do not appreciate the value of education."
- "As a policy it is so. S and T is everything on one's life."

These examples of comments and suggestions by the teachers provided the indication that teachers were capable to create a more realistic and holistic strategy for the implementation of the policy because of their experience and knowledge of the environment in the schools.

Teachers' involvement in the development of the strategy for the implementation of the policy was not possible because of the top-down approach. The importance of the bottom-up approach to bring about an inter-organisational relationship for the development of an effective strategy for implementation of the policy had yet to be given the emphasis.

(3) Structure

The structure of the schools was typically horizontal with not more than three levels. At the top was the head teacher, immediately below it were the Field/Subject heads and at the next level were the teachers. This lean (horizontal) structure was identified in the three schools. This kind of structure was normally found in learning organisations where the culture encourages openness, equality, continuous improvement and change. It allowed sharing and collaborating of information compared to an inflexible hierarchical structure. The structure was also influenced by the strategy.

Schools were under the Ministry of Education and they had to follow the rules and regulations instituted by the ministry. As the 60:40 policy was goal directed, it was the top management (the policy making body) that determined the strategies to achieve the goals.

The teachers had provided some indications that the structure of the schools was designed for efficient performance:

- "Not comfortable to challenge statements from head teacher."
- "Believe final results count."
- "Not sensitive to personal needs."
- "Grades are not given for depending on working with others."
- "Little tolerance for sloppy thinking."
- "Treats all teachers alike."

As the structure of the schools was designed for achieving efficiency in operational performance, it was goal directed. The horizontal structure of the three schools was enveloped with a traditional/task-oriented culture encapsulated with much rules and regulations for the daily operations. The school structure was designed for efficient performance than for effective performance in the sense that it could make changes in response to environmental changes. Under such circumstance, it could not be suitable for achieving the 60:40 policy which required greater flexibility to respond to the dynamic changing environment. This was augmented by the process of globalization and information technology advances. The consequential effect was that science changed consistently and brought about technological changes that influenced the teaching and learning of science and technology. The challenge was for the head teachers and the teachers to compromise between stability and flexibility.

(4) Aspects of School culture

(a) Culture of the Schools

The type of culture prevailing in these schools was of interest as culture played an important role in the implementation of the 60:40 policy. Culture referred to the values, beliefs, norms and attitudes of the teachers in the schools.

Fourteen factors were used to evaluate the culture of the three schools (Table 4.14) and the average score for the factors was 44.2.

Table 4.14: The School Culture

Schools	B	C	A	Average
1. Comfortable to challenge HT's statements.	3.6	3.6	2.4	3.2
2. Penalise late submission of assignments.	3.5	3.1	3.1	3.2
3. Believes final results count.	2.9	2.2	2.6	2.6
4. Sensitive to personal needs of teachers.	3.6	3.7	2.9	3.4
5. Grades depend on working with others.	3.8	3.4	2.6	3.3
6. Feel nervous and tense coming to school.	4.4	4.0	3.5	4.0
7. Prefers stability over change.	2.9	3.0	3.0	3.0
8. Encourage to develop new and different ideas.	4.1	4.1	3.0	3.7
9. Little tolerance for sloppy thinking.	3.1	3.3	2.8	3.1
10. More concern with how conclusion is reached.	3.1	2.8	3.4	3.1
11. Treats all teachers alike.	2.1	2.6	2.9	2.5
12. Frowns on teachers helping each other.	2.5	3.5	3.6	3.2
13. Aggressive & competitive people get advantage.	3.0	2.7	2.5	2.8
14. Encourages teachers to see the world differently.	3.4	3.5	3.1	3.3
Total	45.7	45.5	41.4	44.2

Scale: 1= strongly disagree 2= disagree 3= neutral 4= agree 5= strongly agree
Maximum score = 70 and Minimum score = 14
A high score (49 and above) describes an open, risk-taking, supportive, humanistic, team oriented, easy-going, growth oriented culture. On the other hand, a low score (35 or below) describes a closed, structured, tasked-oriented, individualistic, tense and stability-oriented culture. A score of 60 indicates a more open culture than one that scores 50.
Source: Appendix A: Part D, Section 1: Appraisal of School Culture.

The score of 44.2 indicated that a closed, structured, task-oriented, individualistic, tense and stability-oriented culture (in short a task-oriented culture) was predominant in the three schools. On the other hand, it required at least 49 points to indicate an open, risk-taking, supportive, humanistic, team-oriented, easy-going, growth oriented culture prevailed (i.e. a learning culture). This showed that the three schools were predominantly task-oriented organisations. However, a task-oriented culture was designed for efficient performance in a stable environment. On the other hand, the

values, ideas and practices in a task-oriented culture would become inadequate when effective performance was needed in a rapidly changing environment.

Since the score of 44.2 was above the score of 35, statistically it meant a task-oriented culture existed formally in the three selected schools. For learning culture to be prevalent in the three schools a score of 49 was needed. Whether the three schools had the inclination towards the learning culture could be determined from the study of the following circumstances and practices pursued in the schools:

(a) Leadership Dimension

Table 4.15: Transactional or Transformational Leadership Style

Schools	Transactional Leadership style	Transformational Leadership style	Mann-Whitney U Test
A	26.9/40 (67.3%)	29.7/40 (74.3%)	No difference
C	25.7/40 (64.3%)	27.5/40 (68.8%)	No difference
B	22.2/40 (55.5%)	24.8/40 (62.0%)	No difference

Scoring
1. The maximum score for the transactional leadership is 40.
2. The maximum score for the transformational leadership is also 40.
3. Higher scores indicate that the HT has a strong inclination toward transactional leadership or transformational leadership.

Source: Appendix A: Part D, Section 2: Appraisal of Leadership Dimension

When Mann-Whitney U test is applied to the two samples of scores for each school, it is found statistically that the two samples are identical. Statistically the head teachers in the three schools still practised the transactional leadership style. It showed that even if there was a transformational style of leadership being exercised it had not reached a significant level to affect a paradigm shift in the school environment (Table 4.15).

Teachers from the three schools said that their head teachers had the tendency to be concerned on the following aspects:

- "Focused attention of irregularities, mistakes, exceptions and deviations from what is expected."
- "Monitored performance for errors needing correction."
- "Pointed out what the teacher will receive if she does what is required."
- "Kept careful track of mistake."

- "Told the teacher what to do to be rewarded for her efforts."
- "Was alert to failure to meet standards."
- "Worked out agreements with the teacher on what she will receive if she does what needs to be done."
- "Talked about special rewards for good work."

These were characteristics of a transactional leadership style being practised in the schools. It implied that a task-oriented culture was prevalent in the three schools.

(b) Relationship of Head Teachers with S and T Teachers

The teachers conferred that their Head Teachers actively interacted with them (Table 4.16). They encouraged open communication i.e. they shared values and aims, took risk and experimented on things and they also created ideas and innovated from them. This approach had brought about learning and stimulating creative thinking and established trusting relationships. The teachers appreciated the honesty of the Head Teachers. In one school the Head Teacher was more careful in taking risks and experiments.

Table 4.16: Head Teacher's relationship with Teachers

Schools:	B (%)	A (%)	C (%)	Average(%)
1. HT shares values and aims to the teaching and learning of science/technology subjects.	100	100	100	100
2. HT creates and innovates and leads.	100	100	100	100
3. HT interacts with each other.	100	100	100	100
4. HT takes risks and experiments	100	60	100	87

Source: Appendix A: Part D, Section 5, Factor 1 of Factors perceived as supporting Teachers.

Table 4.17: Head Teacher shares vision with Teachers

	Schools			Average
	B(%)	C(%)	A(%)	(%)
1. Getting teachers to be involved in decision- making	90%	80%	60%	77%
2. Ensuring teachers collectively responsible to the success of the 60:40 policy.	90%	100%	90%	93%
3. Allowing teachers to play leadership role during discussions & meetings about teaching and learning of science & technology subjects.	90%	100%	60%	83%
4. Consulting with teachers	90%	90%	70%	83%
Average				84%

Source: Appendix A: Part D, Section 5, Factor 2 of Factors perceived as supporting Teachers.

The teachers agreed that their head teachers shared their visions with them through their involvements in decision-making, discussions, meetings, consultations and in taking collective responsibility (Table 4.17).

The teachers confirmed that their head teachers encouraged trust worthiness by empowering them to take responsibility in decision-making and to play leadership roles in team activities and even gave them training on team building (Table 4.18).

Table 4.18: Head Teacher Encourages Trust Worthiness among Teachers

	Schools			Average
Encouragement of trust worthiness	A(%)	C (%)	B(%)	(%)
1. Empowers science teachers to make decisions in their areas of expertise.	80%	100%	90%	90%
2. Encourages science teachers to work in teams on school projects, activities or field works.	100%	70%	90%	87%
3. Provides clear leadership roles among teachers.	90%	100%	70%	87%
4. Giving training on team building.	80%	80%	50%	70%
Average				83.5%

Source: Appendix A: Part D, Section 5, Factor 3 of Factors perceived as supporting Teachers.

Table 4.19: Head Teacher encourages Cross-Subject Team Formation

	Schools			Average
Cross-subject team formation	A(%)	C (%)	B (%)	(%)
1. Do you feel happy?	100%	100%	60%	87%
2. Do you feel self-confident?	100%	100%	80%	93%
3. Do you feel as part of a team?	100%	100%	80%	93%
4. Do you feel you get support from other members?	100%	100%	40%	67%
5. Do you feel there is better understanding?	100%	100%	20%	73%
6. Do you feel you are co-owners of decisions made?	90%	80%	20%	60%
7. Do you feel being involved in decision- making?	100%	100%	50%	83%
8. Do you feel you have now more responsibility?	90%	100%	30%	73%
9. Could you like to do the same thing again?	90%	80%	50%	77%
10. Do you feel your ideas being appreciated?	100%	80%	30%	70%
Average	98%	94%	46%	78%

Source: Appendix A: Part D, Factor 4 of Factors perceived as supporting Teachers.

Most teachers agreed that their head teachers encouraged cross-subject team formation (Tale 4.19). However teachers in a school indicated 5 issues they faced in the formation of cross-subject team:

(a) Not getting support from other members.

(b) Not achieving better understanding being gained among team members.

(c) No co-ownership of decisions.

(d) Not becoming more responsible.

(e) Not appreciating ideas being given.

It showed that to achieve effectiveness from cross-subject team activities, greater effort was needed to ensure the development of a trusting relationship among the team members. This situation could be due to the absence of a common objective.

Most teachers conferred that the head teachers provided them with:

- Training in teaching and development, leadership and curriculum development.
- New programmes in terms of leadership skill development.
- External support such as collaboration network opportunities and rewards and recognition for their good performance and achievements (Table 4.20).

The teachers liked their heads for being honest, flexible, opened to discussions and shared her ideas. They also appreciated their heads for encouraging team works.

Table 4.20: Providing support and specific forms of professional development for Science/Technology Teachers.

Schools	A(%)	C(%)	A(%)	Average (%)
1. Send teachers for specific courses like leadership and curriculum development.	100%	100%	70%	90%
2. Conduct in-house teaching and development programmes.	100%	100%	80%	93%
3. Introduce new monitoring & coaching programmes to develop leadership skills.	100%	90%	70%	87%
4. Provide external support such as collaboration network opportunities.	100%	70%	60%	77%
5. Give recognition and rewards for good performance and achievement.	100%	70%	70%	80%
Average	100%	86%	70%	85%

Source: Appendix A: Part D, Factor 5 of Factors perceived as supporting Teachers.

(c) Flexibility of Teachers

Teachers were leaders to their students in their classrooms and in the field activities. Table 4.21 showed that most teachers were not flexible i.e. more authoritative. Those teachers who were flexible were more participative in nature thereby allowing greater

interactions with the students. It encouraged creative thinking and learning among the students. This was established by a teacher who said, "There are good, average and weak students. Focus on good and average students. As for the weak students, give them extra classes during the holidays or after school in particular."

Table 4.21: Magnitude of Flexibility among Teachers

	Teachers		
Schools	Really flexible	Flexible	Not so flexible
A	1 (10%)	1 (10%)	8 (80%)
C	1 (10%)	2 (20%)	7 (70%)
B	3 (30%)	4 (40%)	3 (30%)
Total	5 (17%)	7 (23%)	18 (60%)

Source: Appendix A: Part D, Section 3: Appraise the Magnitude of Flexibility.

(d) Team Work

Table 4.22: Team player attitude in the three secondary schools

Schools	Teachers with strong positive attitude	Teachers with moderately favourable attitude	Teachers prefer working alone
B	3	7	0
C	4	5	1
A	1	9	0
Total	8 (27%)	21 (70%)	1(3%)

Source: Appendix A: Part D, Section 4: Team Player attitudes in the School.

Teachers had good attitude towards team work (Table 4.22). This was because most activities in the schools were team-based from the classrooms to the fields. It implied that most of the teachers understood the concept of working in teams for problem solving and implementing projects. Team work was particularly important for handling difficult and complex situations such as implementing a policy. This was a strength of the schools.

(e) Inter-organisational relationships

The teachers mentioned that they encountered problems with the policy makers in implementing the policy (Table 4.23). They said, "The programmes and activities that

were planned for implementing the policy could not be done due to the lack of funds for development and management activities." As a consequence the teachers pointed out, "The teaching and learning resources and equipment could not be upgraded and the infrastructure facilities like the laboratories for practical training, the school libraries and the ICT facilities could not be improved or to provide more places for increase of students each year."

Table 4.23: Problems between Policy Makers and Teachers (Implementers)

Schools	B	A	C	Average
1. Programmes & activities planned cannot be carried out due to lack of funds for development & management.	3	3	2	3
2. Programme forecast & evaluation to ensure implementation of policy.	3	2	3	3
3. Implementation not planned by school but directed by others.	3	3	2	3
4. Clash of ideas and values between policy maker and implementer.	3	2	3	3

1= totally not critical 2= quite critical 3= critical 4= very critical 5 extremely critical

Source: Appendix A: Part C, Items 1-4.

The teachers also pointed out, "The programme forecast and evaluation to ensure implementation of policy are not defined to enable them to gage the progress in the implementation of the policy. There is no feedback for corrective or remedial actions to be taken."

The teachers said, "The programmes or activities to be implemented are not planned by the schools but directed by other parties and they faced problems in implementing the policy." As a consequence, the teachers admitted, "Clash of ideas and values between policy makers and implementers occurred."

All these problems established the fact that no appropriate control mechanisms were instituted to ensure the smooth implementation of the policy.

4.1.3 Third Research Question

"What are the support and related factors prevailing in the secondary schools to enhance the study of science and technology?"

The support and related factors referred to the supports from the State Education Department and the Ministry of Education, and the parents of the students. These factors enabled the schools to have the necessary resources and supports to encourage more students to take up the study of S/T subjects and would help the schools to implement the strategy to achieve the policy.

(1) Parental Support

Table 4.24: Parental Support

Schools	B(%)	C(%)	A(%)	Average(%)
1. Do parents support the school and their children's education?	80	80	40	67
2. Do parents see the role of schools as the provider of education to their children and therefore do not get involve in their children's education?	60	60	40	67
3. Do parents actively participate in school activities such as parent-teachers meetings, sport day and other functions organised by the school?	40	30	60	30

Source: Appendix A: Part D, Factor 6 of Factors perceived as supporting Teachers.

The support from the parents to the schools depended on their views of the schools. There were two approaches that the parents supported the schools and their children's education, and these could be distinguished through their participations in the school activities (Table 4.24). In schools B and C the parents considered the schools to be providers of education to their children and even though they supported the school and their children's education most of them did not take an active part in the school activities like attending parent-teacher meetings, school's sports day and other functions organised by the school.

On the other hand, in school A the parents did not consider the schools as providers of their children's education or supported the school or their children's education, most of them took an active part in the school activities.

(2) Support from the Education Department and the Ministry of Education

Most teachers said, "The schools did not have adequate facilities like science laboratories and instruments and equipment for the teaching of science and technology subjects. In the same manner, modern teaching audio-visual aids like projectors and teaching programmes were not adequately provided in the schools and furthermore these aids were in not in operating conditions most of the time."

The teachers also said, "There are not enough trained science teachers and the requests for replenishment of supplies for laboratory lessons are often delayed."

Table 4.25: Support from the Ministry of Education and the Education Departments

Schools	B(%)	A(%)	C(%)	Average(%)
1. The school has the necessary facilities like science laboratories and instruments and equipment for the teaching of science subjects.	40	100	90	77
2. There are adequate numbers of trained science teachers to meet the needs of the school.	60	60	80	67
3. Modern teaching audio-visual aids like projectors & computers & teaching programmes are available & in operating conditions all the time.	60	60	100	73
4. Requests for replenish of suppliers for laboratory lessons are not delayed.	40	50	90	60
Average	50	67.5	90	69

Source: Appendix A: Part D, Factor 7 of Factors perceived as supporting Teachers.

The support from the Government was also not consistent from one school to another (Table 4.25). Two schools said that they had the necessary facilities for the teaching of S/T subjects while one school was still in need of the necessary facilities. In one school it had the necessary audio-visual aids in operating conditions and the teaching programmes but the other two schools were short of such equipment and the teaching programmes. Whatever these schools had, the audio-visual equipment was in working condition. A school did not face many problems in the replenishment of supplies while the other two schools had to face delays. However, all the three schools experienced shortage of trained science teachers.

How serious was the Ministry of Education to support the schools and this was what teacher Jane said, "It is dependent on how much encouragement is given to get the students to be interested to take up S and T." Further support of this came from teacher Jone who said, "Provided changes are made in the existing situation to make it possible and it needed the concerted and coordinated efforts of the policy makers and the teachers." Teacher Aisha said, "There is no real encouragement from the government as no incentives are given to the S and T teachers compared with those teaching accounting and economics."

Teacher Jimmy pointed out that the support of the Ministry of Education could come for a different purpose when she said, "The education system is not encouraging students to take up S and T because students are given opportunities to do other studies." The consequential effect according to teacher Juliana, "Students have other interests than to do S and T." She further elaborated, "S and T makes students to be creative but the system makes it difficult because it is exam-oriented."

The supporting and related factors were important to the schools as they enabled the teachers to manage teaching and learning of S and T subjects more effectively.

4.1.4 Fourth Research Question

"What are the prevailing demand conditions in the industries and government sector that provide the impetus for students to join the science and technology stream in the secondary schools?"

The demand conditions related to the economic, social and political factors. Changes in these factors influenced the strategy for the implementation of the policy.

These external forces are acting on the schools and institutions of learning to provide the necessary workforce for the needs of the country and industries. They acted like forces of change and created the challenges for the institutions of learning to produce

the type of workers especially those in the S and T areas. The industries and government demanded for highly specific and sophisticated workers to meet their needs for high technical skills and expertise to improve on their standards, productivity and innovations (Dess & Lumpkin, 2003, p. 119). These demands, therefore, created the challenge for the schools to implement the 60:40 policy.

(1) The Economic Factor

The economic factor referred to the family incomes, parental education levels and jobs held by the family members.

(a) Family incomes

Table 4.26: Family Incomes

Family income per month (total household income)	Schools B	C	A	Total	
a. RM500 or below	3	2	1	6	
b. RM501 - RM1500	8	11	8	27	47
c. RM1501 - RM2500	6	2	6	14	
d. RM2501 - RM3500	4	5	2	11	
e. RM3501 - RM4500	2	2	3	7	22
f. RM4501 - RM5500	1	2	1	4	
g. RM5500 above	9	9	13	31	
Total	33	33	34	100	

Source: Appendix B: Part A, item 8.

The information in Table 4.26 showed that more students were from the low income group (47%) than the high income group (31%) studying S and T in the secondary schools. It implied that those parents with very high monthly incomes encouraged their children to study S and T. On the other hand, parents who earned monthly incomes of RM2, 500 and below also wanted their children to take up the study of S and T education. The remaining 22% of the students were from families with middle incomes. This showed that there was quite an equitable distribution of students coming from the three different parental income groups studying S and T in the three

secondary schools. The predominant group was the low income group, followed by the high income group and the middle income group.

(b) Education Level of Parents

Table 4.27: Education Level of Parents

Highest level of education achieved:	Schools B		C		A		Total		Parents	
Father (F), Mother (M)	F	M	F	M	F	M	F	M		
a. Did not attend school	0	0	2	2	0	0	2	2	4	22%
b. Unknown	6	9	9	10	3	3	18	22	40	
c. Primary	0	0	1	6	1	0	2	6	8	
d. Secondary	12	12	6	8	7	10	25	30	55	
e. Upper Secondary (Form 6)	3	6	3	0	1	3	7	9	16	78%
f. Polytechnic/College	3	0	2	2	6	5	11	7	18	
g. University	9	6	10	5	16	13	35	24	59	
Total							100	100	200	

Source: Appendix A: Part A, Item 9.

Table 4.27 showed 78% of the parents of the students were educated in one way or another. It also showed that 30% of the parents were university graduates, 28% from secondary school, 9% from college, 8% from upper secondary school and 4% from primary school. This implied that 78% of the students were from families where their parents had attended and completed their studies in schools, colleges or universities. The remaining students (22%) were from parents who had not received any formal education. The distribution of students who studied S and T subjects in the secondary schools came from parents with different educational background including those who did not receive any formal education. Nearly one quarter of the students came from families where the parents did not have formal education. Students taking up the study of science and technology subjects came from diverse parental educational backgrounds.

(c) Jobs of the Parents

In Table 4.28, 56% of the students' families were associated in jobs such as engineering, medicine or other S and T fields. On the other hand, 44% of the students

did not have families involved in jobs related to science and technology. Members of the families who were actually involved were fathers, mothers and elder sisters or brothers and relatives. This indicated that students who took up the study of S and T subjects in the schools did not necessary come from families who were involved in jobs related to science and technology.

Table 4.28: Jobs of the Parents

Families involved in jobs associated with engineering, medicine or other fields associated with S & T.				
Schools	B	C	A	Total
a) Yes	15	24	17	56
b) No	18	9	17	44
Total	33	33	34	100
Those involved in the jobs.				
a) Father	6	9	9	24
b) Older sister/brother	7	11	6	24
c) Mother	0	3	3	6
d) Relatives	15	18	6	39

Source: Appendix B: Part A, items 10 & 11.

(2) Social Factor

The social factor involved two aspects namely the social interactions between the parents and the schools and the parents and their children. Most parents, who put their trust on the schools to educate their children, did not participate actively in the school activities. However, those parents who had no confidence in the schools tended to take an active part in their children's school activities such as teachers-parents meetings and sports.

Teacher Aisha said, "Students' attitudes have become a problem as they do not show great interest in their study because their lives have become easy because their parents are well off. On the other hand, well-educated parents show more concerned of their children's education." This situation was substantiated by teacher Liew who said, "Students tend to take life easy. They have been spoon-fed and pampered by their

parents. However, there are other students who are really interested to do S and T and they really do well on their own. These are from more affluent families."

However teacher Sila cautioned when she said, "When talking to poor students or advising them it has to be done in a strict manner. Those students who have developed positive attitude are able to perform better." She further reasoned and said, "Students take back to their parents what the teachers said in class and some parents would have negative aspect of the schools and would create problems."

On the other hand, teacher Tan said, "Some students are willing to do S and T but are forced by circumstances to do other studies because of family background. Students from poor families or breakdown families help their parents through part-time working. They earn some money to enable them to get what they need such as hand phones and for their food but their study become less important to them." The parents of these students could not take an active part in the school activities.

Teacher Maggie said, "20% of the students good in science want to go for Arts. Many parents do not encourage their children to go for science because science is difficult. The school promotes good students to go for science but not all good students want to go for science. Students' life is so easy today, they do not think of having to study or work hard. They do not want to study science because they think it is difficult." The teacher also found that it was difficult to talk to the parents on such matter. The parents were not receptive to the teachers' encouragement. This was confirmed by teacher Nellie who said, "Students now-a-day are not prepared to meet challenges. They are pampered. They want to do things in an easy way e.g. using calculators."

(3) The Political Factor

This factor referred to the opportunities for employment, job advancement and research and development. These opportunities facilitated the implementation of the policy.

Most of the students reasoned that they looked forward to further their education in S and T at the higher level because a profession in S or T would enable them to earn an attractive salary. This implied that employment opportunities were important to students who were interested to study S and T in the schools. This aspiration of the students was also important for them to achieve academic success (Leong & others, 1990). It had an important implication to the implementation of the 60:40 policy.

The study also found that the teachers believed that the policy would enable the county to become a developed nation. Teacher Ling said, "The country needs many students in S and T to become a developed nation and this is where the policy is for. The industries need such kind of workers." This was supported by teacher Lee when she said, "Because S and T are needed to enhance productivity of the country as seen in the developed world. Without S and T many things cannot be developed or implemented from agriculture to automobile." Teacher Amy who had visited many countries said, "People who are skilled in the field of S and T are needed in many jobs and in developed countries their industries need S and T workers." On the other hand, teacher Thelma pointed out, "Counties that are not developed have little job opportunities and low standard of living. Developed countries are progressive and produce creative and quality goods. Furthermore, many professionals are leaving the country to the developed world." Teacher Amana warned, "Without S and T the country cannot be really developed and to more further ahead. This situation can be seen from many examples in the country. The country has to depend for many developed countries to buy sophisticated equipment and machineries. The country needs more professionals to become a developed nation in order to attain high incomes, improved and healthy life style and opportunities for higher skill jobs." Teacher Aini warned, "Although S and T are necessary for our lives, progress of industries depends on S and T. Job market is

limited for S and T graduates to reach top positions." She further stated, "S and T are good for the country because it can provide more job opportunities."

These were the expectations of teachers of what a developed nation could be. The desired situation and the real situation were not the same. In recent years the services sector had progressed and overtook the manufacturing sector.

4.2 Summary of the findings

The tangible factors of the schools were not at the optimal state for the teaching and learning of S and T or to accommodate the increasing number of students each year. There were always not enough trained S and T teachers. Augmenting to this problem, the teachers were not confident that the policy would be achieved. However, teachers had the intellectual properties such as know-how, expertise, experience and most of all the skills for the teaching of S and T subjects. These capabilities though necessary for the implementation of the policy in the schools were not effectively and objectively applied to encourage more students to study S and T subjects.

The conditions of the factors at the schools were also not aligned for the smooth implementation of the policy. This was because the 'strategy-structure-culture fit' did not exist. The strategy that was developed did not have the required structure and culture to support it in order to achieve the objective of the policy. The S and T teachers were not fully aware of the nature of the strategy required for the implementation of the policy and as such they did not have the confidence or the conviction to be fully committed to the policy. Consequence to this was the lack of the creative and innovative abilities (the intangible assets) to meet the challenges faced by the schools to bring about the successful implementation of the policy. The central problem appeared to be the need of an appropriate strategy developed by the policy

planners and the policy implementers for the implementation of the policy. There was the absence of the interactive process between policy formation and implementation and as a consequence the parenting role of the policy makers to add value to the implementation of the policy at the schools was missing. The eventual outcome was that the gap between the actual and desired results could not be reviewed at both the implementation stage and the policy formation stage. This was because the feedbacks were not given the importance. Therefore corrective or remedial actions could not be executed as and when needed.

The external conditions such as the support and related factors were not well coordinated and collaborated to enhance the schools' capability in implementing the policy. The Ministry of Education was not playing an effective role to provide the necessary resources and support to encourage the schools to implement the policy. Furthermore the demand conditions such as economic, social and political were not at the optimal level to support the implementation of the policy at the schools.

For the successful implementation of the policy, the school factors, factor conditions of the schools and the external factor conditions needed to be well coordinated and collaborated. They were interdependent of each other to ensure the implementation of the policy. However such a situation was not indicated.

The findings established the fundamental problems that affected the implementation of the 60:40 policy in the three selected secondary schools.